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GB 2293973 A	GB 2261197 A	GB 1213930 A
GB 0719048 A	EP 0109927 A1	US 5690375 A
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(58) Field of Search

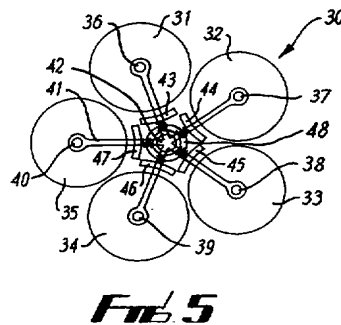
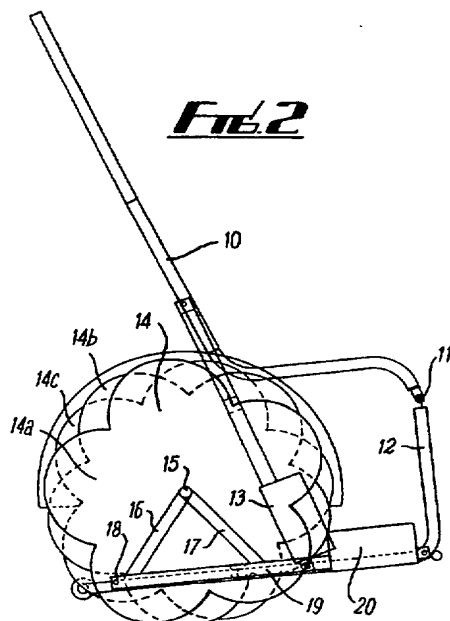
UK CL (Edition R) **B7C CGG CGX , B7D DNS , B7H**
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INT CL⁷ **B60B 3/00 11/00 19/00 19/12 19/14 , B62B**
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(54) Abstract Title

Patient transport apparatus and wheel construction

(57) The apparatus has eg a pair of wheels 14 mounted thereon. Each wheel comprises one or more non-circular, multi lobed member(s). Where a plurality of members 14a-14c are provided side-by-side these can be aligned to provide an overall lobed outline to the wheel which can then be used to surmount steps, or de-aligned to provide a near-circular running surface for level use.

Alternatively, the wheel 30 may comprise a plurality of independently rotatable subwheels or discs 31-35 which can be braked for use on steps, or run freely for level running.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print incorporates corrections made under Section 117(1) of the Patents Act 1977.

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FIG. 1

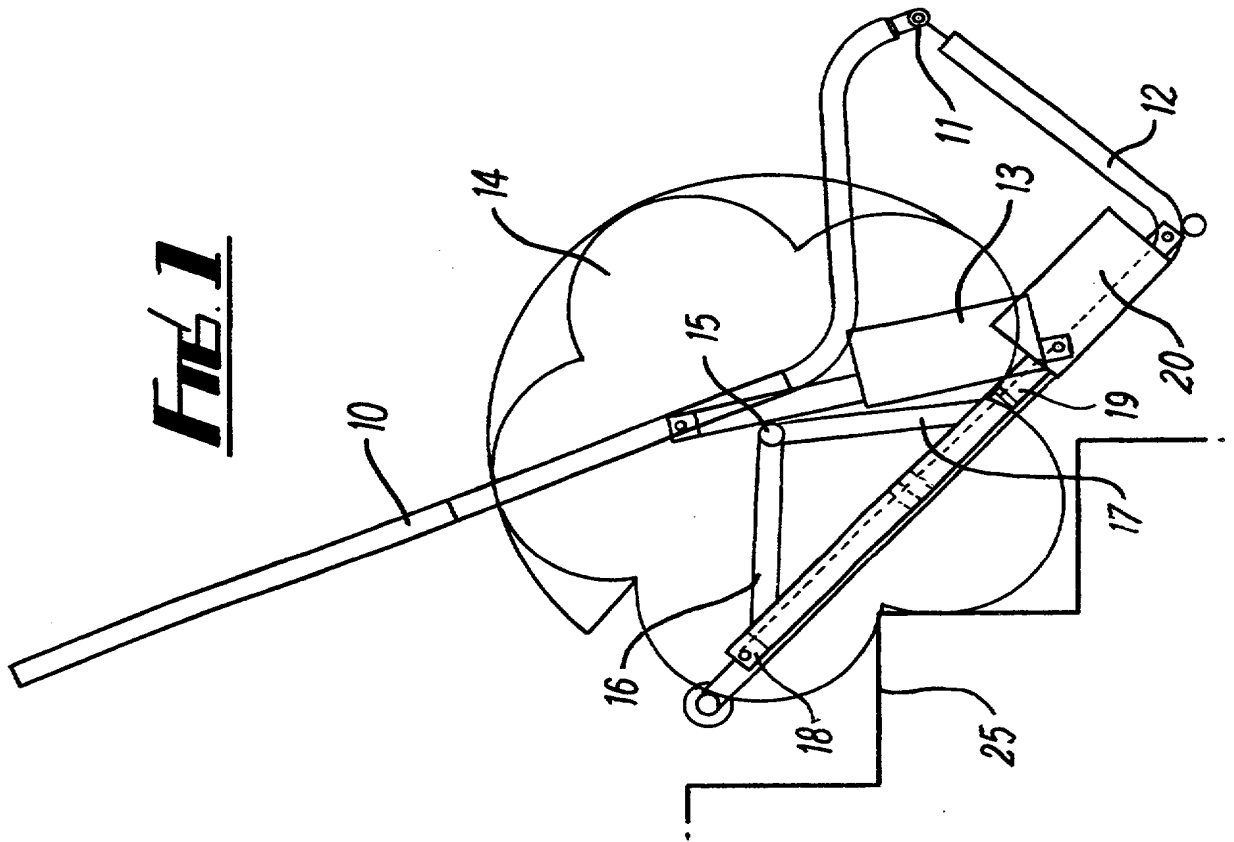
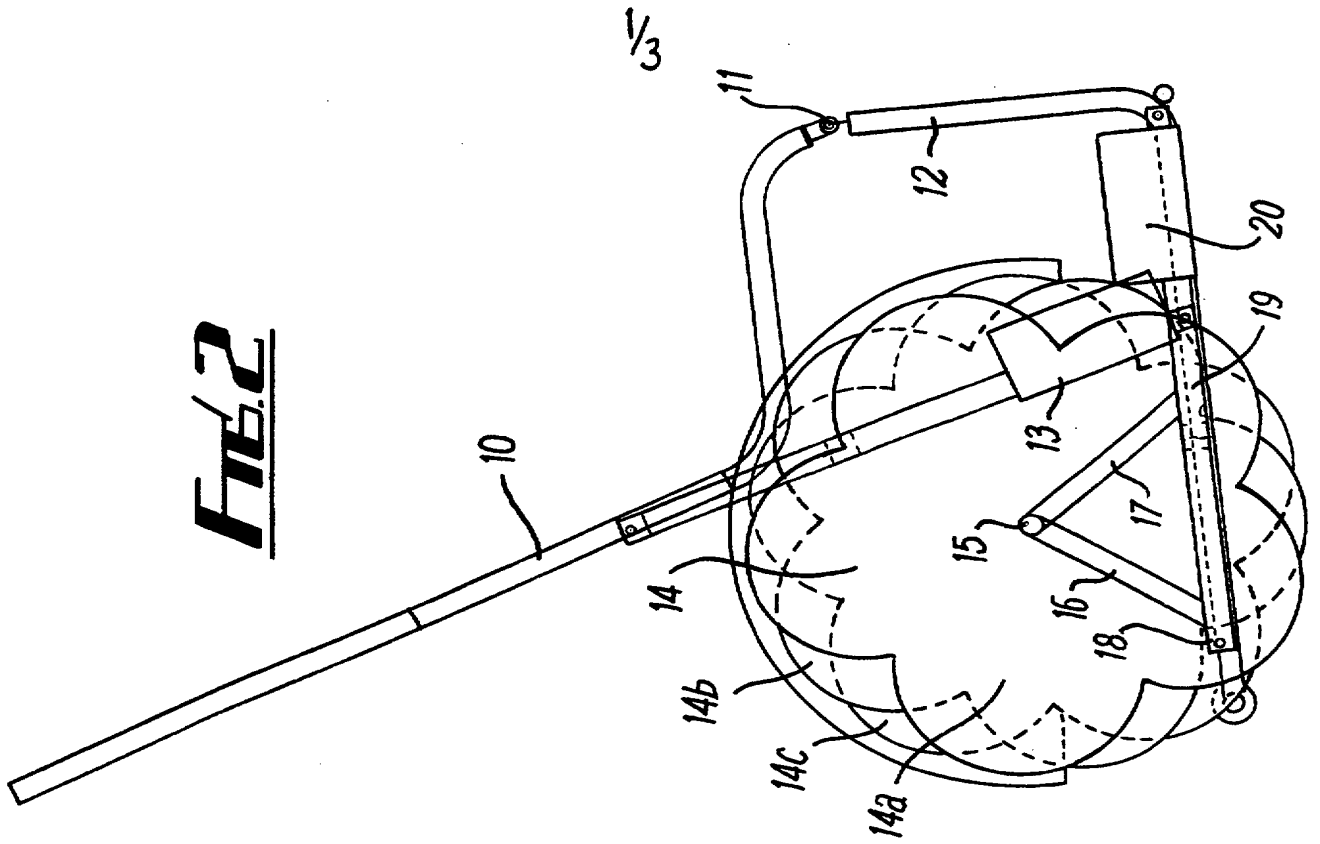


FIG. 2



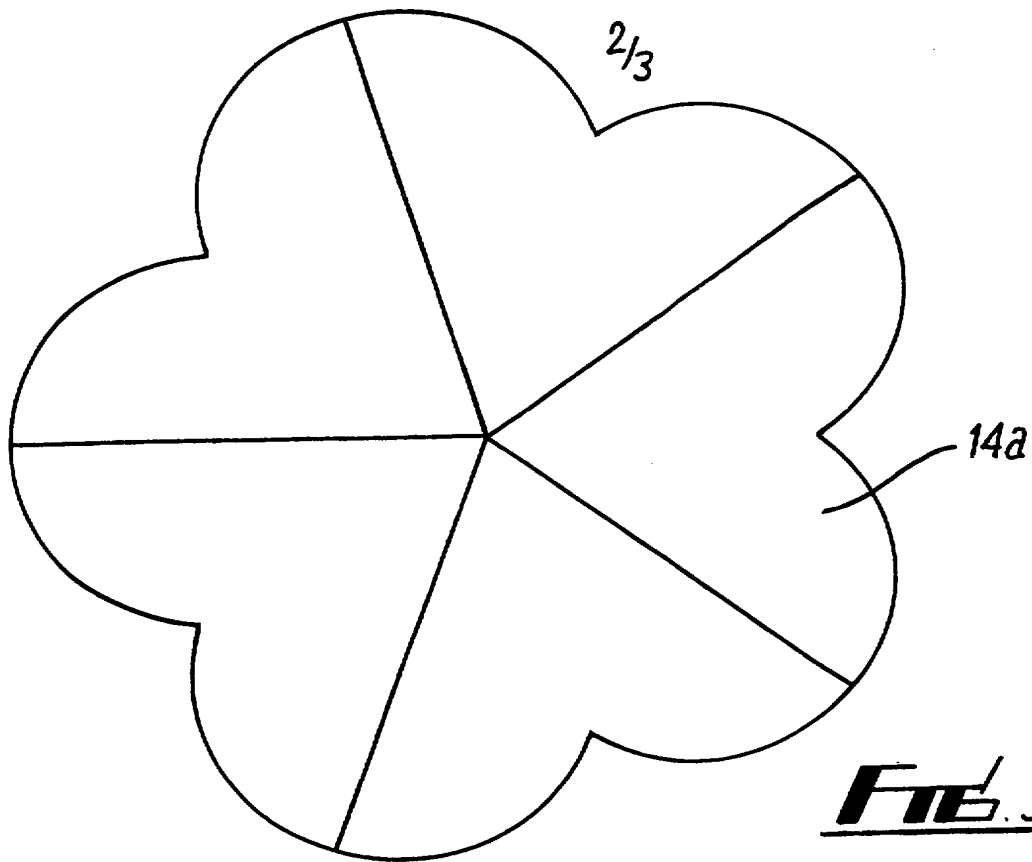


FIG. 3

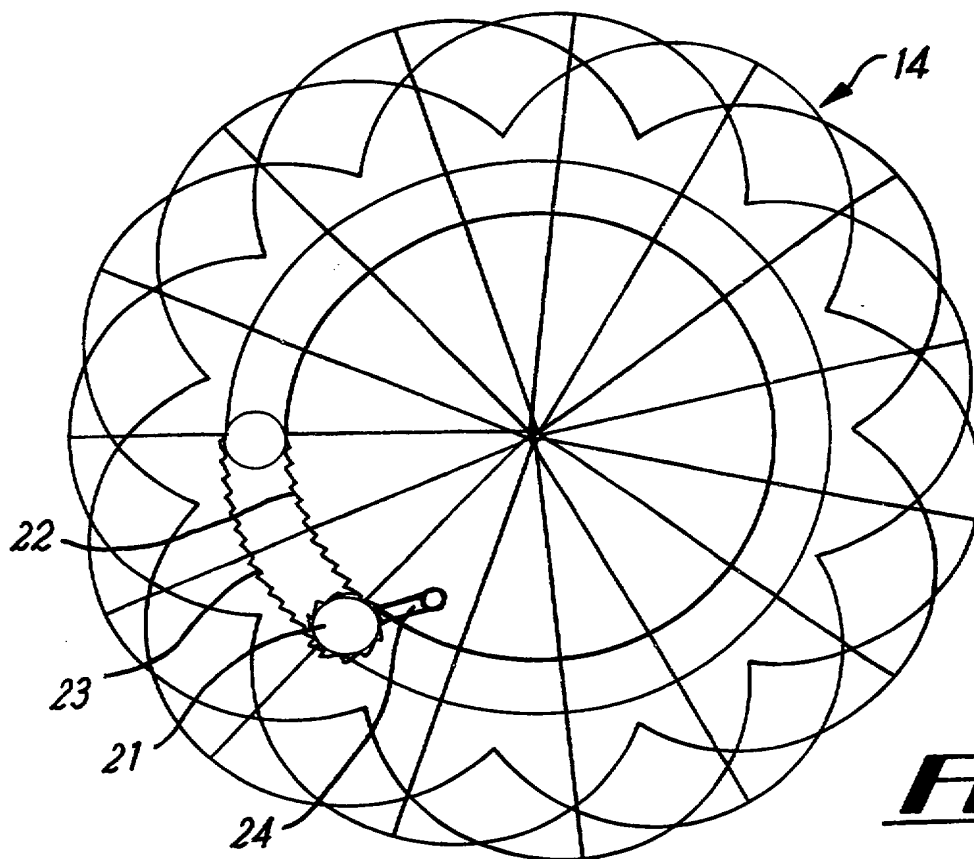


FIG. 4

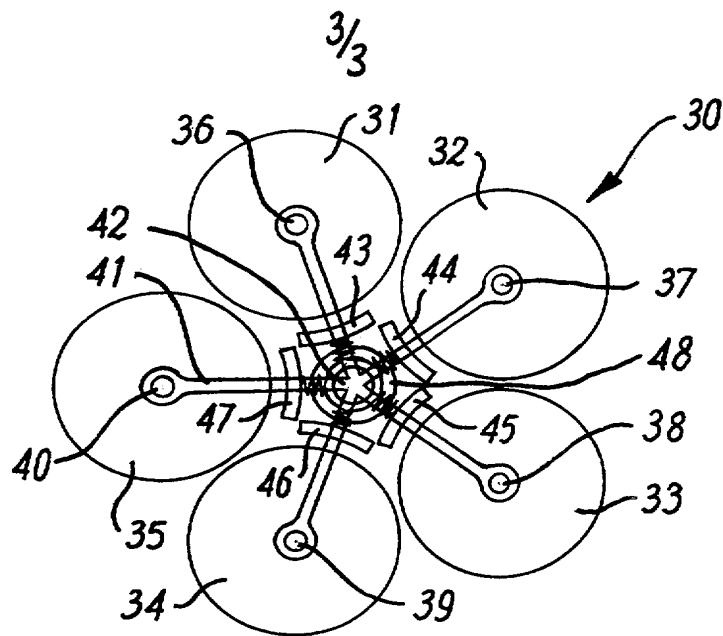


FIG. 5

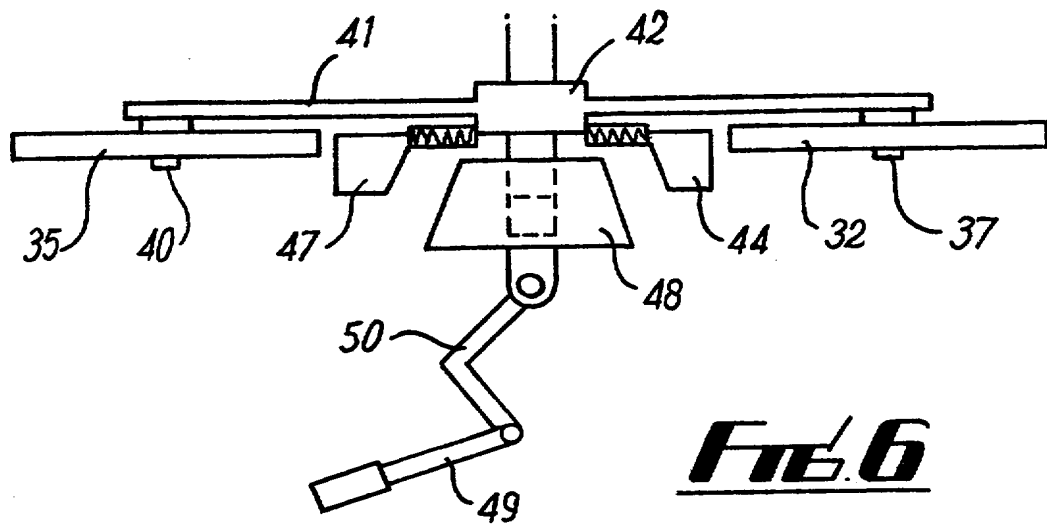


FIG. 6

PATIENT TRANSPORT APPARATUS
AND WHEEL CONSTRUCTION

This invention relates to a patient transport apparatus and to a wheel construction suitable for such apparatus, but having possible wider utility.

5 In our co-pending UK Application No. GB-A-2305644, we describe an apparatus for use in raising a patient from a recumbent position to avoid heavy manual lifting (and possible injury to the lifter). The apparatus comprises a frame which can be strapped to the patient, who, following a collapse or injury has been placed in the recovery position (lying on one side
10 with limbs arranged to prevent rolling onto the face). The frame has a seat part attached and the patient can then be rolled over onto their back. An inflatable airbag below the seat can then be inflated by pumping to raise the patient into a sitting position. This apparatus is suitable for raising patients in domestic or nursing home situations so that they can be assisted to their
15 feet, or transferred to a chair, or to a trolley or wheelchair as the apparatus is not provided with wheels.

 Alternatively, hoists may be used to raise the patient onto a trolley or stretcher carrier, or a device such as the AIR PAL (Trade Mark). A patient is laid on an air filled mattress, the underside of which is perforated
20 by thousands of minute holes. The escaping air provides an upward force which "lubricates" movement of the mattress to reduce resistance to sliding of the mattress.

Stretcher carrying trolleys, hoists and other patient transporting devices all use relatively small diameter castors, and mattresses of the AIR PAL type are not suitable for use on other than fairly flat surfaces. None of these are ideal to carry a patient over uneven or wet terrain, or up or down stairs. The latter is the most frequent problem encountered, as most falls by elderly people or other patients occur at home or in sheltered accommodation such as nursing homes, and in many cases stairs and/or steps have to be negotiated. The small diameter of most castor wheels make such obstacles difficult to negotiate.

An object of the invention is to provide a patient transport apparatus, and a wheel suitable for use with such apparatus, which will enable the transport apparatus to be used for transit up and down steps and over uneven or wet terrain.

According to a first aspect of the invention a patient transport apparatus includes two or more wheels, each of which comprise a non-circular member having a running surface or periphery consisting of at least three arcuate convex lobes.

According to a second aspect of the invention, a wheel comprises a non-circular member having a running surface or periphery consisting of at least three arcuate convex lobes.

The lobes are preferably of equal dimensions, and angularly symmetrically disposed relative to the centre of the wheel.

The lobes may be three, four or preferably five in number.

The lobes preferably comprise arcs of circles, the centres of which are located on equi-angularly spaced radii of the wheel.

5 The lobes may each comprise a circular disc or sub-wheel, which may be independently rotatable. The sub-wheels or discs may be provided with brake means whereby the sub-wheels or discs may be prevented from rotating or released for rotation, either altogether, or individually.

In a variant, a number of disc or subwheel lobes, e. g. three may be provided, and the gaps occupied by arcuate shoe or runner members.

10 Each sub-wheel or disc may have an associated brake shoe, disposed to bear upon the hubward side of the respective subwheel or disc, and the brake shoes may be operable by a conical or tapered clutch member which is concentrically mounted around, and displaceable axially with respect to the axle or hub of the wheel, by means for example of hand-operable lever
15 and crank, the brake shoes being spring biased towards the hub, so that they are forced against the subwheels by the clutch, and retracted by the springs when the clutch is moved out of engagement with the brake shoes.

In a preferred embodiment of the invention a wheel comprises two or more such non-circular members, each consisting of an equal number of
20 convex lobes and being substantially identical, and provided with means whereby the two or more non-circular members can be selectively locked in either of two relative angular positions, in one of which the lobes of both

or all of the non-circular members coincide and are aligned to provide a combined member having the shape of any one of the members, and in the other of which the non-circular members are disposed so that their lobes are spaced to subdivide the angles between the adjacent lobes of any one of the members.

By way of example, in the case of a wheel comprising three coaxial non-circular members, each of three equispaced lobes, at 120° intervals, in the said other position the lobes of each of the members will be offset by an angle of 40° to the lobes of each preceding member. With three members and four equal lobes per member, the offset angle will be 30° , and with three members and five equal lobes per member, the offset angle will be 24° .

The changeover between aligned and non-aligned segments of the members may be effected by a rotatable pinion engaging with a segment gear extending over at least the arcuate width of one lobe.

A pair of such wheels may be mounted on a seat, and the wheels preferably have a relatively large diameter, in the order of 600mm.

The wheel configuration wherein the non-circular members are aligned is optimised for the descent of stairs, as the cusps between the lobes provide a notch for nesting with the edges of steps, whilst the crests of the lobes rest on the treads. The configuration wherein the lobes of the non-circular members are de-aligned and equally spaced is optimised for

running on a level surface as this represents the nearest approach possible with this construction to an ordinary circular wheel. The wheel construction thus becomes effectively dual purpose, enabling a patient transporting apparatus to be used both in ascending or descending steps or stairs, and on level surfaces such as floors, with a quick and easy changeover being effected in between.

A preferred embodiment of patient transporting apparatus, and a wheel for such apparatus according to the invention will now be described by way of example with reference to the accompanying drawings wherein:-

10 Figure 1 is a diagrammatic side view of a patient transport apparatus according to the invention, in use on steps or stairs;

Figure 2 is a similar view of the apparatus of Figure 1 in use for running on a level surface;

Figure 3 is an enlarged view of one wheel of the apparatus;

15 Figure 4 is a similar view of the wheel of Figure 3 configured for running on a level surface,

Figure 5 is a view of the an alternative embodiment, comprising independently rotatable subwheels and;

20 Figure 6 is a diagram illustrating braking of the Fig 5 embodiment.

Figure 1 shows a diagrammatic side view of a patient transport apparatus according to the invention. The apparatus comprises a seat part

10 pivoted at 11 to a base frame 12, and a ram 13 extends between the seat part 10 and base frame 12 to adjust the relative position of the seat part and base frame. A pair of large diameter wheels 14, one to each side, is mounted on the base frame, only one wheel 14 being shown in the drawings.

Each wheel 14 has a hub 15 which is mounted on a pair of arms 16, 17 and provides a pivotal attachment for the arms. The other end of arm 17 is pivoted to a fixed attachment 18 on the base frame 12 whilst the other end of arm 17 is pivoted to a slidable member 19 on a piston of an actuator cylinder 20. Hubs 15 may be connected by an axle shaft extending across the base frame.

Each wheel 14 is made up of three side-by-side wheel members, this is not apparent from Figure 1, but is better shown in Figure 4. These comprise an outer wheel member 14a, a middle wheel member 14b and an inner wheel member 14c.

The apparatus of Figure 1 is shown optimised for descending or ascending steps or stairs. The ram 13 is retracted so that the seat part 10 lies back into the space between the wheels 14, and the wheel members 14a, 14b and 14c of each wheel 14 are "synchronised", that is they are aligned.

In accordance with the invention, each wheel member 14a, 14b, 14c is formed as a disc with a lobed periphery, each with five lobes. Any

number of lobes above three is possible, but five is at present considered optimum. The lobes each present a convex bulge, with a cusp separating the lobes, and the radius of curvature of each lobe is less than the radius of curvature of the mean diameter of the wheel member. The lobed wheel members 14a-14c may be "synchronised" with their lobes and cusps aligned as in Figures 1 and 3, or "de-synchronised" as in Figures 2 and 4, with the lobes of successive wheel members offset by an angle equal to the angle between lobes (or cusps) divided by the number of wheel members.

With three wheel members each with five lobes, the angle between lobes is 72° , and the offset angle in the "de-synchronised" state of successive wheel members is 24° .

When the wheel members of each wheel 14 are "synchronised" (i.e. in the Figure 1 and 3 positions), a five-lobed wheel is produced which acts in a similar manner to a pinion with the steps 25 acting as a rack, the edges of the steps 25 engaging on the cusps of the wheel 14, and the lobes coming to rest on the treads of the steps.

"De-synchronising" the wheels to the Figure 2 and Figure 4 positions produces effectively a fifteen-lobed running surface for the wheel, which is a good approximation to a circular wheel for use on level floors or flat terrain.

"Synchronisation" and "de-synchronisation" (or alignment and de-alignment) can be effected as shown in Figure 4. A pinion 21 is mounted

on the middle wheel member 14b, and an inner ratchet segment 22 is provided on the outer wheel member 14a and an outer ratchet segment 23 on the inner wheel member 14c. The pinion 21 is rotatable by turning a handle 24 and this causes contrary motion of the outer and inner wheel members relative to the middle wheel member. The ratchets 22, 23 extend
5 over a short arc only, equivalent to e.g. the angular width of one lobe.

A further embodiment of the invention is shown in Figs 5 and 6 in this embodiment, a wheel member 30 comprises five sub-wheels 31, 32, 33, 34 and 35, each mounted on a respective sub-hub 36, 37, 38, 39, 40
10 for independent rotation, on a five armed spider 41 covered by a main central hub 42.

Each sub wheel 31-35 has an associated brake shoe 43-47 disposed to contact the subwheel on the hubward side. The brake shoes are connected by tension springs to the hub 42, so that the brake shoes are
15 biased radially towards the hub, out of engagement with the subwheels.

Engagement with the subwheels 31-35 for braking is effected by a conical clutch member 48, which is displaceable axially with respect to the hub 42 by means of a hand lever 49 and crank mechanism 50 to engage with corresponding inclined surfaces on the hubward faces of the brake
20 shoes, to force the brake shoes 41-45 outwards from the hub 42 to engage with the peripheries of the subwheels 31-35 and prevent rotation of the latter. The brake shoes may instead be biased into the 'on' state.

The wheel member 30 can be used in the same way as shown in Fig 1 for negotiating steps or stairs, with the subwheels braked by the brake shoes. However, for free running over a level surface, the brake shoes are disengaged so that the subwheels can freely rotate, and the chair etc can
5 be run on one or two of the subwheels rotating independently without rotation of the main wheel member 30.

The wheel construction described is capable of use not only with patient transporting apparatus, but also for transporting goods both indoors and out of doors, particularly where both steps and level surfaces must be
10 negotiated.

The apparatus of the invention may be used to transport patients within private homes and institutions, and the apparatus for raising patients from a recumbent position described in our earlier application GB-A-2305649 mentioned above may be modified by providing for the mounting
15 of detachable wheels 14 after the patient has been raised, to then transport the patient from the scene for example to an ambulance or to a bed.

Especially where, e. g. three discs or subwheels are used, the gaps may be occupied by arcuate shoes or runners which provide a sliding or running surface.

Claims

1. A Patient transport apparatus including two or more wheels, each said wheel comprising a non-circular member having a running-surface or periphery consisting of at least three arcuate convex lobes.

5 2. A wheel comprising a non-circular member having a running surface or periphery consisting of at least three arcuate convex lobes.

3. Apparatus, or a wheel according to claim 1 or 2 respectively, wherein the lobes are of equal dimensions and are angularly symmetrically disposed relative to the centre of the wheel.

10 4. Apparatus, or a wheel, according to claim 3, wherein said lobes are three in number.

5. Apparatus, or a wheel, according to claim 3, wherein said lobes are four in number.

15 6. Apparatus, or a wheel, according to claim 3, wherein said lobes are five in number.

7. Apparatus or a wheel, according to any proceeding claim, wherein a wheel comprises two or more such non-circular members, each consisting of an equal number of convex lobes and being substantially identical, and means whereby the two or more non-circular members can be selectively
20 locked in either of two relative angular positions in one of which the lobes of both or all of the non-circular members coincide and are aligned to provide a combined member having the shape of any one of the members,

and in the other of which the non-circular members are disposed so that their lobes are spaced to subdivide the angles between adjacent lobes of any one of the members.

5 8. Apparatus or a wheel, according to any of claims 1 to 6, wherein the lobes each comprise a circular disc or sub-wheel which is independently rotatable.

9. Apparatus, or a wheel, according to claim 8, wherein the subwheels or discs are provided with brake means whereby the subwheels or discs may be prevented from rotating, or released for rotation.

10 10. Apparatus, or a wheel, according to claim 9, wherein the brake means comprise a brake shoe associated with each disc or subwheel, disposed to bear upon the hubward side of the respective subwheel or disc, and the brake shoes are operable by a conical or tapered clutch member which is concentrically mounted around and displaceable axially with respect to the axle or hub of the wheel, by means of a hand operable lever and crank, the brake shoes being spring biased towards the hub so that they are forced against the subwheels by the clutch and retracted by the springs when the clutch is moved out of engagement with the brake shoes.

15 11. Apparatus, or a wheel, according to any proceeding claim, wherein
20 the gaps between lobes or subwheels are occupied by arcuate shoes or runners.



INVESTOR IN PEOPLE

Application No: GB 0009812.9
Claims searched: 1-11

Examiner: Roger Binding
Date of search: 18 July 2000

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.R): B7C (CGG, CGX); B7D (DNS); B7H (HNF)
Int Cl (Ed.7): B60B 3/00, 11/00, 19/00, 19/12, 19/14; B62B 5/02
Other: Online WPI EPODOC JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2293973 A (JONAS), see Figs 4a-c and page 4, line 28, to page 5, line 24.	1-3, 7
X	GB 2261197 A (LEPEK)	1-3, 5, 8
X	GB 1213930 A (FLEMING)	2-4, 8, 9
X	GB 0719048 A (HARTMANN), see especially Fig 6.	1-4, 8-11
X	EP 0109927 A1 (VON ROHR)	2, 3, 5, 6, 8
X	US 5690375 A (SCHNEIDER), see column 4, line 57, to column 5, line 11.	1-3, 8, 9
X	US 5323867 A (ALLARD), see Figs 3 & 5.	2, 3
X	US 4960179 A (LEACH)	2, 3
X	US 4674757 A (MARTIN)	1-4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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